4. PERFORMANCE MEASURES

Performance measures form the backbone of the IMS in that they are at the center of the overall processes of identifying transportation deficiencies, ranking the deficiencies, and therefore forming a basis for remediary action. As most components of the IMS program, areas of performance to be monitored must be uniquely tailored to the State of Indiana. Performance measures must be closely linked to both perceived and reported stakeholder deficiencies, as well as to additional INDOT goals.

In order not to discriminate performance areas on the basis of distance, vehicle flows, and other common "drivers", the majority of performance measures developed includes a "normalization" component as part of the algorithm. For example, the method selected to view congestion over a local road segment was to divide the time lost due to congestion by vehicle miles traveled (VMT). The normalization procedure was utilized for the majority of performance measures.

The first category of performance applies directly to the road access links to the facility. In this category, emphasis was placed on travel time delay due to congestion, safety (e.g., accidents, injuries), environmental pollution, and associated costs. To more accurately capture deficiency areas, care was taken to distinguish between "local" and "State/US" performance measures. Please refer to the previous chapter for more information on the distinction between the two. Accordingly, each type of link is the source for an individual performance measure. Access road related performance measures include:

- safety
- lost time
- other user costs
- environmental.

Subsequent to developing the first category measures, the IMS team developed additional measures that complement, from an intermodal perspective, link access characteristics. The idea consisted in enlarging the measures to include mode connectivity, relative ease of access, and special considerations related to freight traffic. This second category of non-access road related performance measures includes:

- number of modes
- transit access frequency
- parking utilization
- provision of bicycle racks
- population within 30 miles of a commercial service airport

- provision of on-dock rail
- ability to handle containers.

The remainder of this section includes a brief discussion for each of the main performance areas. The algorithms for each performance measure are included at the end of this document in Appendix H.

4.1 Safety

- Accident rate	Accident rate occurring on the intermodal facility access roads up to the nearest State Road, US Road, or Interstate
- Severity distribution	Fatality, injury, and property damage accident rates
- Safety cost	Estimated annual cost based on accident severity distribution

Under safety, the main performance measure consists of the total number of accidents incurred over the link for a one year period, per vehicle mile traveled. Examination of safety records showed that although the number of fatalities observed on a given link varies widely, the total number of accidents typically does not. The approach selected in terms of data selection for the access links was one of taking the average of the accidents over the last three years. The approach was consistent for both the local and State/US components of the access links.

A second set of safety performance measures related to the distribution of accidents on the link, namely fatalities, injuries, and property damage accidents. As in the case of total accidents, these types of accidents were normalized by VMT.

Finally, the safety cost calculations reflect INDOT's current valuation of fatality, injury, and property damage comprehensive costs. The multipliers here are standard figures issued by the U.S. Department of Transportation: $2.7 million per fatality, $175,000 per injury, and $4,500 per property damage accident.

4.2 Lost Time

- Lost time per mile	Total hours per peak hour lost due to congestion and safety
- Lost time cost	Estimated annual cost based on above performance measure

Lost time represents the incremental time required to transport people and goods compared to free-flow speeds. The measure is particularly revealing when compared to the travel time that was used for a given access link. The lost time per mile measure requires knowing what average actual speeds are being experienced on the access links and what the free-flow speeds are for the type(s) of access link.

Lost time cost measures the user cost due to congestion. In this case, the measure can be calculated by simply multiplying the number of hours of lost time by a user "value" of time. The "opportunity cost" per hour used was $10, a commonly used travel demand modeling figure.

4.3 Other User Costs

- Other user cost	Direct operating or capital costs borne as a result of deficiencies

"Other user costs" consists of those user costs not already included in direct safety costs and direct congestion costs. Other costs could include, but are not limited to, the additional wear and tear on an automobile, and direct capital and operating costs that the private sector must pay to mitigate safety or congestion (e.g., increased fuel consumption). One example of a direct operating cost, debated during the second IMS Advisory Committee meeting, consisted of cost for a railroad to pay for flagmen. Industry literature, such as the American Automobile Association and IMS stakeholders, provide the majority of sources for this information.

Please note that other user costs do not, however, include the costs of pollution to society.

4.4 Environmental

- Fuel consumption	Amount of fuel consumed based on the number of trips generated by the facility
- Pollution generated	Pollution generated based on the number of trips generated by the facility

Vehicle fuel consumption (and thus, pollution emitted) is primarily driven by the vehicle type and speed. Weather conditions, terrain, and other factors have a secondary effect. Though not identified as a perceived or actual deficiency by any member of the advisory committees, the IMS team added

environmental performance measures due to their success with IMS programs in other States, and anticipating INDOT's potential future needs in this area.

Several environmental models exist for the estimating fuel consumption and pollution, including Emfac7f, which is widely used for California, and Mobil 5, a model applied to most of the States and originally developed for the Environmental Protection Agency. In its application of the consumption/emission rates from the latter, the IMS team used the same average (congestion) speed derived for the lost time performance measure as primary driver. Performance calculations of the fuel consumed and pollution generated will thus, by default, also follow lost time trends. This is to say, access links that exhibit a high aggregate lost time will also exhibit a high consumption and pollution pattern. This linkage is further discussed in the chapter "Deficiency Analysis".

4.5 Non Access Road-Related Performance Measures

4.5.1 Number of modes

Designation of which modes serve intermodal facilities of statewide significance provides IMS users an immediate picture of potential connectivity, options for freight and passenger movement.

4.5.2 Transit access frequency

For passenger stations, transit access frequency provides a useful indicator for accessibility. For the Indiana IMS, this measure represents bus access in the majority of cases. In the case of a bus station, however, transit access would represent the frequency of any rail service. Units for this performance measure are expressed in terms of total inbound and outbound movements per day.

4.5.3 Parking utilization

Congestion of on-site parking facilities represents another indicator of interest to IMS users. For many passengers, availability of parking during peak hours is of paramount importance to selecting a travel mode or even one facility over another. For this reason, the parking utilization performance measure examines the percentage of occupied to total parking spots during a typical weekday peak hour.

4.5.4 Provision of bicycle racks

Provision of bicycle racks as a performance measure illustrates accessibility of this non-traditional transportation mode to transit and other passenger facilities. This is a Boolean (yes/no) field.

4.5.5 Population within 30 miles of a commercial service airport

Access to major primary or commercial airports in the State of Indiana, measured by the population or percentage population, is represented by this performance measure. The thirty mile limit is, of course, arbitrary. Discussions with the advisory committee produced mixed reactions as to what should constitute a "reasonable" distance from one's home or business to the nearest commercial service airport. One committee member even argued for a 70 mile radius as "reasonable" distance to travel. The GIS tool's capabilities of selecting data within a given circle ("Select by Circle") is highly flexible and can be easily modified to accommodate a larger radius for a case study.

When considering Indiana's population relative to accessing Indiana commercial airports, one thing to keep in mind is the cross-State distance to major out-of-state airports, such as the Chicago O'Hare and Louisville airports. Proximity to these airports will lower the effective Indiana population distant from any commercial airport.

4.5.6 Provision of On-Dock Rail

On-dock rail constitutes an important feature that differentiates ports from the competition due to rail carrier ease of access. Often implied with the rail itself are loading and unloading cranes or conveyor systems to service the awaiting barges or ships.

4.5.7 Ability to Handle Containers.

Similarly to on-dock rail, the ability of a port to handle containerization constitutes another key differentiating feature. The same applies to cargo airports. For intermodal freight facilities, this feature is a non-issue since all facilities, almost by definition, must be equipped to handle container and trailer transfers from rail to truck.

Though technically only support fields for freight performance, the truck and rail movements generated by freight facilities are briefly discussed below.

4.5.8 Truck Trips Generated

Within freight facilities, airports, intermodal freight facilities and ports can be considered significant truck trip generation point sources. While the number of trips generated on the local access links (both local and State/US components) is generally a small percentage of the total, truck movements also disproportionately contribute to the roadway wear and tear, congestion and pollution. Where the information was available, the truck trips generated was developed for all intermodal facilities.

4.5.9 Rail Car Loads Generated

The number of rail car loads generated by major Indiana intermodal facilities was also determined where the information was available. In the future, estimations of the pollution generated through diesel emissions can be generated.